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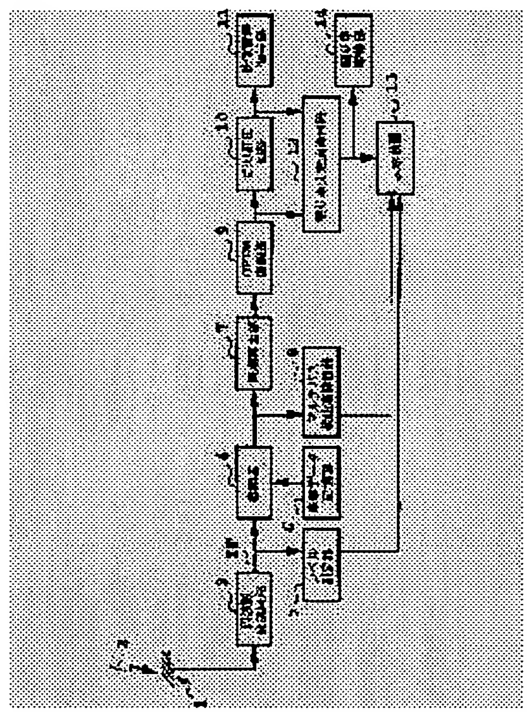
(54) METHOD FOR RECEIVING DIGITAL SIGNAL AND ITS DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To normally keep a decoding signal in high quality with respect to a method and a device for receiving a digital signal, which receives the digital signal error correction-encoded, modulated and transmitted.
SOLUTION: A reception antenna 1 receives the signal which is error correction-encoded, modulated and transmitted by a transmitting means at a unspecified position. An OFDM demodulating part 9 obtains a demodulating digital signal from the receiving signal in accordance with a prescribed demodulating system. An error correcting circuit 10 corrects the error of the demodulating digital signal in accordance with a prescribed error correcting system. An error rate measuring arithmetic circuit 12 obtains the error rate of the demodulating digital signal based on the error-corrected digital signal and the demodulating digital signal. A display device 13 and an error rate converting part 14 reports an error rate.



LEGAL STATUS

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] Especially this invention relates to the digital signal receiving approach and equipment which receive the digital signal which error correction coding was carried out, was modulated and was transmitted about the digital signal receiving approach and equipment.
[0002]
[Description of the Prior Art] Transmission was performed by an analog transmission or digital transmission when carrying out voice / an image or] a radio transmission to the broadcasting station located from the junction site of an unspecified location in a specific location for the former, for example, television broadcasting. In the case of the analog transmission, at the broadcasting station of a receiving side, the receiving level of a RF signal was supervised, or the multi-pass and the interference were supervised by the waveform monitor, and the location and sense of a receiving antenna were adjusted to it so that optimal reception could be performed.
[0003] Moreover, in digital transmission, since it was not able to check whether optimal reception is performed even if it supervises a wave, the location and sense of a receiving antenna were adjusted so that only the receiving level of a RF signal might be supervised and the maximum receiving level might be obtained.
[0004]
[Problem(s) to be Solved by the Invention] However, it was difficult to always maintain the quality of the signal which error correction coding was carried out, was modulated and was transmitted in adjustment of the receiving antenna in the above-mentioned digital transmission, for example from the relay car which moves [junction / marathon] in high quality. That is, if the receiving level of a RF signal is more than fixed level and strains and interferences, such as a multi-pass strain, are below fixed level, in digital transmission, a perfect error correction can be performed, and a sending signal and the high-quality decode signal of homogeneity can be acquired in it. However, when neither receiving level nor a strain nor an interference can maintain fixed level once, a perfect error correction cannot be performed, a noise cannot mix in a decode signal, and a high-definition image or voice cannot be transmitted. Since the distance and the direction of a transmitting agency changed every moment in receiving the signal transmitted from the relay car which moves, adjusting the location and sense of a receiving antenna so that an always perfect error correction can be performed under supervising only receiving level had the problem of being difficult.
[0005] Then, this invention is accomplished in view of the above-mentioned trouble, and aims at offering the digital signal receiving approach and equipment which can adjust a receiving antenna so that an always perfect error correction can be performed and a high-quality decode signal can be maintained.
[0006]
[Means for Solving the Problem] In order to attain the above-mentioned purpose, by the approach of this invention The receiving step which receives with an antenna the signal which error correction coding was carried out with the transmitting means in an unspecified location, was modulated, and was transmitted, The recovery step which acquires a recovery digital signal from an input signal according to a predetermined recovery method, The correction step which carries out the error correction of said recovery digital signal according to predetermined error correcting system, It considered as the configuration which comes to contain the error rate calculation step which searches for the error rate of said recovery digital signal based on the digital signal by which the error correction was carried out, and said recovery digital signal, and the information step which reports said error rate.
[0007] Moreover, by the approach of this invention, it considered as the configuration which compares said digital signal by which the error correction was carried out and said recovery digital signal, and searches for the bit error rate of said digital signal by which the error correction was carried out in said error rate calculation step.
[0008] Moreover, by the approach of this invention, vibration from which a frequency changes according to said error rate was considered as the configuration which an oscillating means is made to generate in said information step.
[0009] Moreover, by the approach of this invention, in said information step, while making said oscillating means generate said vibration, it considered as the configuration in which said error rate is displayed on a display.
[0010] Moreover, by the approach of this invention, oscillation frequency of said vibration was considered as the configuration which is audio frequency.
[0011] Moreover, by the approach of this invention, oscillation frequency of said vibration was considered as the configuration which is the frequency in which the somesthesis below audio frequency is possible.
[0012] Moreover, by the approach of this invention, said transmitting means is a mobile station and said unspecified location was

considered as the changing configuration.
[0013] Moreover, by the approach of this invention, frequency conversion of said input signal is carried out in said recovery step. While reproducing the synchronizing signal contained in the signal by which frequency conversion was carried out based on a comparison result as compared with a criteria synchronizing signal, carrying out a rectangular frequency multiplex recovery and acquiring said recovery digital signal It asked for the level of said signal by which frequency conversion was carried out, the information about the multi-pass in said input signal was searched for based on said comparison result, and it considered as the configuration which contains further the display step which displays the level of said signal by which frequency conversion was carried out, and the information about said multi-pass on a display.
[0014] Moreover, by the approach of this invention, information about said multi-pass was considered as the configuration containing at least one of the number of said multi-passes, a time delay, and level.
[0015] In order to attain the above-mentioned purpose, with the equipment of this invention The antenna which receives the signal which error correction coding was carried out with the transmitting means in an unspecified location, was modulated, and was transmitted, A recovery means to acquire a recovery digital signal from an input signal according to a predetermined recovery method, The correction means which carries out the error correction of said recovery digital signal according to predetermined error correcting system, It considered as the configuration which comes to contain an error rate calculation means to search for the error rate of said recovery digital signal based on the digital signal by which the error correction was carried out, and said recovery digital signal, and an information means to report said error rate.
[0016] Moreover, with the equipment of this invention, it considered as the configuration which compares said digital signal by which the error correction was carried out and said recovery digital signal, and searches for the bit error rate of said digital signal by which the error correction was carried out with said error rate calculation means.
[0017] Moreover, with the equipment of this invention, vibration from which a frequency changes according to said error rate was considered as the configuration which an oscillating means is made to generate with said information means.
[0018] Moreover, with the equipment of this invention, with said information means, while making said oscillating means generate said vibration, it considered as the configuration which displays said error rate on a display.
[0019] Moreover, with the equipment of this invention, oscillation frequency of said vibration was considered as the configuration which is audio frequency.
[0020] Moreover, with the equipment of this invention, oscillation frequency of said vibration was considered as the configuration which is the frequency in which the somesthesis below audio frequency is possible.
[0021] Moreover, with the equipment of this invention, said transmitting means is a mobile station and said unspecified location was considered as the changing configuration.
[0022] Moreover, with the equipment of this invention, frequency conversion of said input signal is carried out with said recovery means. While reproducing the synchronizing signal contained in the signal by which frequency conversion was carried out based on a comparison result as compared with a criteria synchronizing signal, carrying out a rectangular frequency multiplex recovery and acquiring said recovery digital signal It asked for the level of said signal by which frequency conversion was carried out, the information about the multi-pass in said input signal was searched for based on said comparison result, and it considered as the configuration which includes further a display means to display the level of said signal by which frequency conversion was carried out, and the information about said multi-pass on a display.
[0023] Moreover, with the equipment of this invention, information about said multi-pass was considered as the configuration containing at least one of the number of said multi-passes, a time delay, and level.
[0024]
[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained to a detail, referring to a drawing.
[0025] (Gestalt of the 1st operation) Drawing 1 is the block diagram showing the gestalt of operation of the 1st of the digital signal receiving set which applied this invention.
[0026] The digital signal receiving set shown in drawing 1 is applied to the receive section of FPU (Field Pick-up Unit) used in case a radio transmission is carried out [voice / an image or] by digital transmission to the broadcasting station located from an unspecified location in a specific location for television broadcasting. Moreover, it is applicable also to the receiving set which receives the signal of the integrated digital broadcast (ISDB:Integrated services digital Broadcasting) which unifies and broadcasts ground system digital television broadcast, digital voice broadcast, or digital information.
[0027] Here, it explains as what receives the RF signal transmitted with the digital sender of relay cars, such as marathon junction which is a mobile station, by error-correcting-code-izing a digital video signal and a sound signal, and carrying out a rectangular frequency multiplex (OFDM:Orthogonal Frequency Division Multiplex) modulation. Therefore, the location of a relay car is unspecified and changes every moment. Although it collapses as an error correcting code-ized method and coding is common, block coding and trellis coding may be performed.
[0028] RF signal 2 which carries out Iriki to a receiving antenna 1 is changed into the intermediate frequency signal IF of the frequency beforehand set up by the frequency changing circuit 3. Adjustable [of a receiving antenna 1] is made free in the installation location and sense. An intermediate frequency signal IF is branched and inputted into correlator 4 and the level measuring instrument 5. Before branching of an intermediate frequency signal IF, an AGC (Automatic Gain Controle : automatic gain control) circuit is not prepared, but although omitted by a diagram, after branching to a correlator 4 side, an IFAGC circuit and the intermediate frequency amplifier are formed. Therefore, the field strength of RF signal 2 which carries out Iriki to a receiving antenna 1 can be relatively measured by measuring the level of an intermediate frequency signal IF with the level measuring instrument 5. Correlator 4 is formed in order to take correlation of a synchronizing signal before restoring to the signal

by which the OFDM modulation was carried out.
[0029] Drawing 2 is drawing showing the frame structure of the signal (OFDM signal) by which the OFDM modulation was carried out.
[0030] The interleave of the OFDM signal is carried out on the time-axis and the frequency shaft. One Fr consists of modulation symbol trains Sm which consist of two or more symbols following the reference symbol train Sr and the reference symbol train Sr of the OFDM signal following the non-signal period T0. The reference symbol train Sr is usually hundreds ofmicrosec from dozens ofmicrosec, contains the synchronizing signal, and it is established in order to take a synchronization on a time-axis. One symbol of the modulation symbol train Sm consists of a guard interval and a signal period following a guard interval. This guard interval is prepared in order to mitigate a multi-pass. The error correcting code used for an error correction at the time of decode of the image data and voice data which were error-correcting-code-ized, and these data is contained at the signal period.
[0031] In order to receive the OFDM signal of the above-mentioned frame structure to return to drawing 1 and explain, in order to grasp the head location of the modulation symbol train Sm, with correlator 4, the reference symbol train Sr is detected first. In order to detect the reference symbol train Sr and to take a synchronization, the non-signal period T0 is detected first, and it asks for the near location of the reference symbol train Sr. Next, the synchronizing signal and the criteria data storage section 6 in the received reference symbol train Sr perform the comparison with the criteria synchronizing signal memorized beforehand. That is, correlation of both synchronizing signals is taken and it asks for the exact location of the synchronizing signal received by detecting a peak. By performing such processing with correlator 4, it becomes possible to get to know the exact time location of the modulation symbol train Sm.
[0032] Here, in the output of correlator 4, supposing a multi-pass strain arises in a receiving RF signal and a direct wave and a delay wave are inputted from a receiving antenna 1, as drawing 3 shows, two or more peaks will arise. The 1st peak with the highest level is a peak by the direct wave, and two or more peaks to which the level after the 2nd falls gradually are delay ****** peaks (drawing 3 two waves). Then, since the location which the peak with the highest level produced is a location of the signal received on the highest level, in the synchronous playback section 7, predetermined regeneration is performed based on the 1st peak.
[0033] Moreover, the output of correlator 4 is supplied to the multi-pass detection arithmetic circuit 8, it is compared with the criteria synchronizing signal which the criteria data storage section 6 has memorized beforehand by performing logical operation, and a multi-pass time delay is found for the level difference of the peak of a direct wave and a delay wave to a DU ratio (desired-undesired ratio) from the number of the peaks of the output of correlator 4 from the location of a peak where the multi-pass wave number is time.
[0034] In the OFDM recovery section 9, it restores to the output of the synchronous playback section 7 with the recovery method according to the OFDM modulation technique of a transmitting side, and decode digital data is outputted. That is, generally FFT (Fast Fourier Transform; fast Fourier transform) is performed, it gets over, and a frequency (time amount) interleave is carried out, and it maximum-likelihood-decoding-izes. the decode digital data from the OFDM recovery section 9 is influenced of the strain or the noise, and is data which were alike to that extent, responded and contained the error.
[0035] The decode digital data containing an error is supplied to the error correction circuit 10, and an error correction is carried out with predetermined error correcting system. The error coding method of a transmitting side should respond to this error correcting system, it is collapsed, and supports coding, block coding, or trellis coding. If the error contained in decode digital data is below a fixed error rate according to the correction capacity of error correcting system, the error correction of the error correction circuit 10 can be carried out 100%. The image voice decode section 11 is supplied, a decode video signal and a decode sound signal are acquired, and the output data of the error correction circuit 10 can reproduce the video signal and sound signal which were transmitted by the transmitting side, and a homogeneous quality signal.
[0036] However, since a part of output of the error correction circuit 10 has an error when the error contained in decode digital data from the error correction circuit 10 is over the fixed error rate, the noise which is not in the video signal transmitted by the transmitting side and a sound signal will mix in a decode video signal and a decode sound signal.
[0037] So, with the gestalt of this operation, based on the decode digital data by which the error correction was carried out in the decode digital data and the error correction circuit 10 from the OFDM recovery section 9, the bit error rate of decode digital data is computed by logical operation with the error rate measurement arithmetic circuit 12 so that the error correction circuit 10 can perform an error correction with a certain amount of margin to the fixed error rate according to the correction capacity of error correcting system and may reproduce completely the video signal and sound signal which were transmitted by the transmitting side.
[0038] It is specifically taking an exclusive OR with the decode digital data by which the error correction's was carried out to the decode digital data before the error correction from the OFDM recovery section 9, and the number of bits from which the decode digital data by which the error correction was carried out to the decode digital data before correction differs is counted. Since this number of bits is the error number of bits, a bit error rate can be searched for by **(ing) this error number of bits with the total number of bits.
[0039] In case it transmits digitally using a terrestrial electric wave, it is usually used and collapses, and if it is 1 or less % of bit error rate, in the case of error correcting system, such as a sign, the error correction circuit 10 can perform a perfect error correction. Therefore, if the bit error rate measured by the error rate measurement arithmetic circuit 12 is 1 or less %, since there will be no error in the decode digital data by which the error correction was carried out from the error correction circuit 10, it can be considered that the measured value by the error rate measurement arithmetic circuit 12 is the bit error rate of the decode digital data from the OFDM recovery section 9.

[0040] Then, the measured value by the error rate measurement arithmetic circuit 12 is supplied and displayed on a display 13. at this time, the bit error rate of the decode digital data from the OFDM recovery section 9 can be easily known by what a foreground color is changed for according to measured value (for example, 0.01 or less % of bit error rates, and 0.01% -- super- -- 0.1 or less % and 0.1% -- super- -- it is made to change according to ** etc. 1 or less % and 1%). In addition, the pattern of an arbitration configuration from which a foreground color changes as mentioned above according to measured value may be displayed, without displaying the measured value itself.
[0041] The information about the above mentioned multi-pass from the measured value and the multi-pass detection arithmetic circuit 8 from the level measuring instrument 5 is further supplied to an indicating equipment 13, and it is displayed with a bit error rate. Performing the display described above with the indicating equipment 13 can report the bit error rate of decode digital data, the receiving level of RF signal 2, and the information about the multi-pass of RF signal 2 to the vision of the coordinator of a receiving antenna 1.
[0042] The measured value by the error rate measurement arithmetic circuit 12 is further supplied to the error rate transducer 14. The error rate transducer 14 is constituted including for example, an audio frequency oscillator, an FM modulator, an AM machine, power amplifier, a loudspeaker, etc., and a bit error rate is changed into the vibration according to the error rate. That is, the signal of the audio frequency (an FM modulator is used) from which a frequency changes with these error rate transducers 14 according to the bit error rate of the decode digital data from the OFDM recovery section 9 measured by the error rate measurement arithmetic circuit 12 can be supplied to a loudspeaker, and the acoustic vibration from which a frequency changes according to a bit error rate can be generated.
[0043] Moreover, if an AM machine is used, the signal of audio frequency with which level changes according to the bit error rate of the decode digital data from the OFDM recovery section 9 can be supplied to a loudspeaker, and the acoustic vibration from which sound pressure (******) changes according to a bit error rate can be generated. Thus, the bit error rate of decode digital data can be reported to the acoustic sense of the coordinator of a receiving antenna 1.
[0044] According to the gestalt of this operation, thus, the coordinator of a receiving antenna 1 Even if receiving conditions change according to the location (namely, distance and a direction) of the relay car which is the mobile station which changes every moment Since the information about a bit error rate, the receiving level of RF signal 2, and the multi-pass of RF signal 2 can be supervised on real time by vision and the acoustic sense, To the bit error rate in which the error correction of the error correction circuit 10 is possible, with a margin, the location and sense of a receiving antenna 1 can always be easily adjusted so that an error correction may be possible. For this reason, even when receiving the sending signal from a mobile station, what was always transmitted from the mobile station, a homogeneous high-quality decode image, and decode voice can be offered. Since extent of a bit error rate can be known by the acoustic sense even if it does not see indicating equipments, such as meter and a monitor, especially with the gestalt of this operation, it is the the best for adjustment of the receiving antenna installed in the outdoors.
[0045] (Gestalt of other operations) Although the error rate transducer 14 was constituted from a gestalt of the 1st operation including an audio frequency oscillator, an FM modulator, an AM machine, power amplifier, a loudspeaker, etc. If the error rate transducer 14 is constituted including the audio frequency oscillator, FM modulator and AM machine which oscillate the frequency in which the somesthesis for example, below the number of audio frequency is possible, power amplifier, vibrator, etc. The signal of the frequency which can be felt (an FM modulator is used) with which a frequency changes according to the bit error rate of the decode digital data from the OFDM recovery section 9 measured by the error rate measurement arithmetic circuit 12 is supplied to vibrator. Vibration from which a frequency changes according to a bit error rate and which can be felt is generable by vibrator.
[0046] Moreover, if an AM machine is used, the signal of the frequency which can be felt with which level changes according to the bit error rate of the decode digital data from the OFDM recovery section 9 can be supplied to vibrator, and vibration from which ****** changes according to a bit error rate and which can be felt can be generated. Thus, the bit error rate of decode digital data can be reported like a pocket bell with vibrator to the tactile sense of the coordinator of a receiving antenna 1. Trouble is not made to a perimeter, in order to be able to acquire the same effectiveness as the gestalt of the 1st operation and not to emit sound further with the gestalt of this operation.
[0047] In addition, although the example constituted from a gestalt of each above-mentioned implementation so that an antenna coordinator might be displayed and told about the information about a multi-pass with the rate of bit apologize was explained, the information about a multi-pass may be constituted so that may be an auxiliary means for acquire a high-quality decode signal, and only a bit error rate may be displayed on a display 13, and it may change into vibration by the error rate transducer 14 and receiving conditions may be reported to an antenna coordinator. Moreover, since the information about a multi-pass is a strictly auxiliary means, it does not need to display the all, and it may give a selection indication of at least one of the multi-pass wave number, a multi-pass time delay, and DU ratios suitably.
[0048] Moreover, although the gestalt of each above-mentioned implementation explained the example which receives the sending signal from the mobile station in the unspecified location in the case of antenna adjustment at the broadcasting station in a specific location, it is possible to apply, also when the digital receiving set of the mobile station in an unspecified location receives the sending signal from the base station in a specific location. Moreover, when the digital receiving set of the home of the viewer in other specific locations receives the signal from the broadcasting station in a specific location, you may apply.
[0049]
[Effect of the Invention] As explained above, the location and sense of an antenna can be adjusted so that an always perfect error correction can be performed according to this invention, and the digital signal receiving approach and equipment which can

always maintain the quality of a decode signal in high quality can be offered.
[0050] Namely, an antenna receives the signal which error correction coding was carried out with the transmitting means in an unspecified location in this invention, was modulated, and was transmitted. Since restored to the input signal and the recovery digital signal was acquired, the error correction of this recovery digital signal was carried out, the error rate of a recovery digital signal was searched for based on the digital signal and recovery digital signal by which the error correction was carried out and the error rate is reported Even if the location of a transmitting means changes every moment and receiving conditions change, while an antenna coordinator can always know the error rate of a recovery digital signal and its workability of antenna adjustment improves A margin can be given to the error rate in which an error correction is possible, antenna adjustment can be performed, and the decode signal of high quality can always be acquired.

[Translation done.]

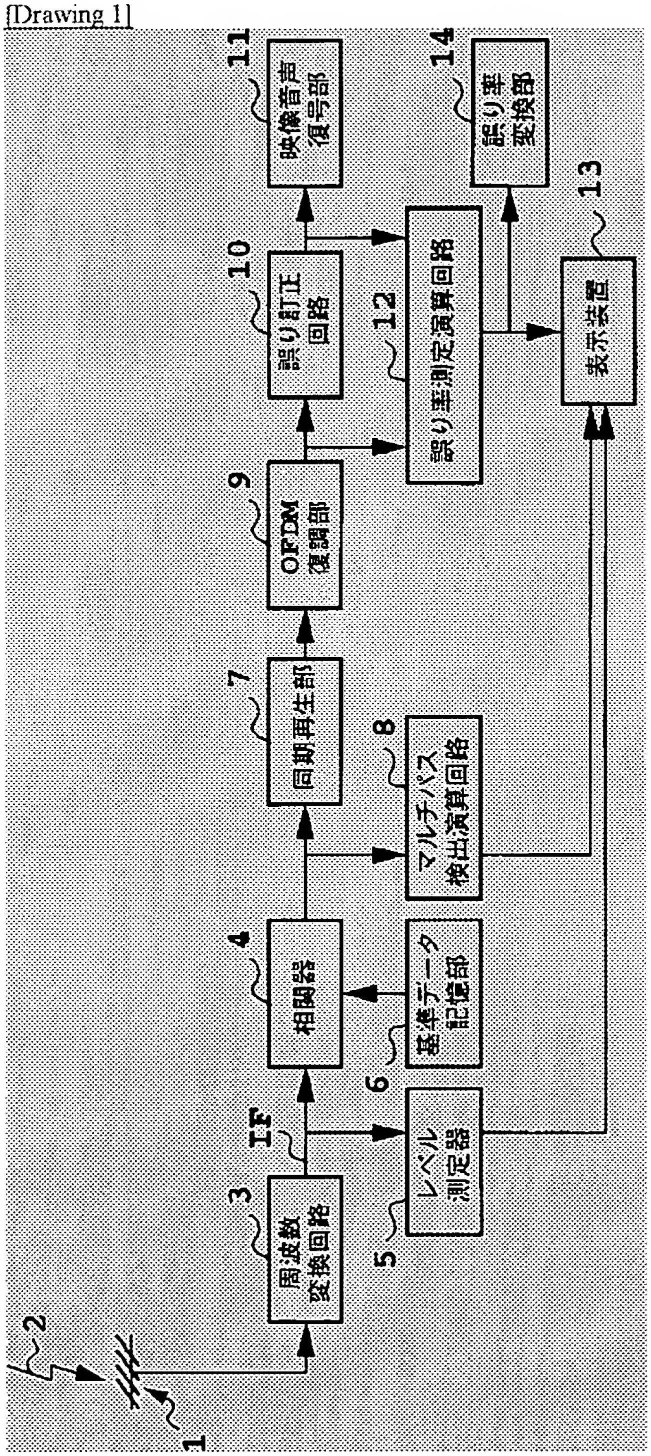
DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the block diagram showing the gestalt of operation of the 1st of the digital signal receiving set which applied this invention.
[Drawing 2] It is drawing showing the frame structure of the signal (OFDM signal) by which the OFDM modulation was carried out.
[Drawing 3] It is the wave form chart showing an example of an output wave of correlator 4.
[Description of Notations]
1 Receiving Antenna
3 Frequency Changing Circuit
4 Correlator
5 Level Measuring Instrument
6 Criteria Data Storage Section
7 Synchronous Playback Section
8 Multi-pass Detection Arithmetic Circuit
9 OFDM Recovery Section
10 Error Correction Circuit
12 Error Rate Measurement Arithmetic Circuit
13 Display
14 Error Rate Transducer

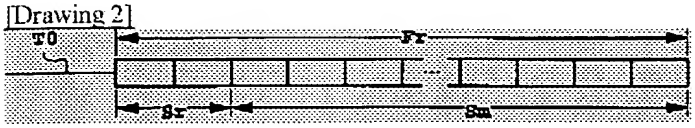
[Translation done.]

DRAWINGS

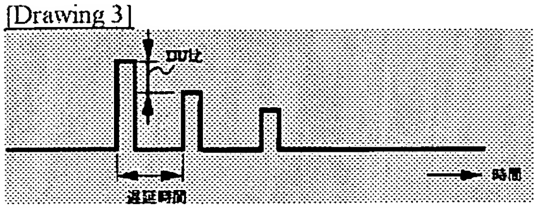
[Drawing 1]



[Drawing 2]



[Drawing 3]



[Translation done.]

CLAIMS

[Claim(s)]
[Claim 1] The receiving step which receives with an antenna the signal which error correction coding was carried out with the transmitting means in an unspecified location, was modulated, and was transmitted, The recovery step which acquires a recovery digital signal from an input signal according to a predetermined recovery method, The correction step which carries out the error correction of said recovery digital signal according to predetermined error correcting system, The digital signal receiving approach characterized by coming to contain the error rate calculation step which searches for the error rate of said recovery digital signal based on the digital signal by which the error correction was carried out, and said recovery digital signal, and the information step which reports said error rate.
[Claim 2] The digital signal receiving approach according to claim 1 characterized by comparing said digital signal by which the error correction was carried out and said recovery digital signal, and searching for the bit error rate of said digital signal by which the error correction was carried out in said error rate calculation step.
[Claim 3] The digital signal receiving approach according to claim 1 characterized by making an oscillating means generate vibration from which a frequency changes according to said error rate in said information step.
[Claim 4] The digital signal receiving approach according to claim 1 characterized by displaying said error rate on an indicating equipment in said information step while making said oscillating means generate said vibration.
[Claim 5] The oscillation frequency of said vibration is the digital signal receiving approach according to claim 3 or 4 characterized by being audio frequency.
[Claim 6] The oscillation frequency of said vibration is the digital signal receiving approach according to claim 3 or 4 characterized by being the frequency in which the somesthesis below audio frequency is possible.
[Claim 7] It is the digital signal receiving approach according to claim 1 characterized by for said transmitting means being a mobile station and said unspecified location changing.
[Claim 8] In said recovery step, carry out frequency conversion of said input signal, and while reproducing the synchronizing signal contained in the signal by which frequency conversion was carried out based on a comparison result as compared with a criteria synchronizing signal, carrying out a rectangular frequency multiplex recovery and acquiring said recovery digital signal Ask for the level of said signal by which frequency conversion was carried out, and the information about the multi-pass in said input signal is searched for based on said comparison result. The digital signal receiving approach according to claim 1 characterized by including further the display step which displays the level of said signal by which frequency conversion was carried out, and the information about said multi-pass on an indicating equipment.
[Claim 9] The information about said multi-pass is the digital signal receiving approach according to claim 8 characterized by including at least one of the number of said multi-passes, a time delay, and level.
[Claim 10] The antenna which receives the signal which error correction coding was carried out with the transmitting means in an unspecified location, was modulated, and was transmitted, A recovery means to acquire a recovery digital signal from an input signal according to a predetermined recovery method, The correction means which carries out the error correction of said recovery digital signal according to predetermined error correcting system, The digital signal receiving set characterized by coming to contain an error rate calculation means to search for the error rate of said recovery digital signal based on the digital signal by which the error correction was carried out, and said recovery digital signal, and an information means to report said error rate.
[Claim 11] The digital signal receiving set according to claim 10 characterized by comparing said digital signal by which the error correction was carried out and said recovery digital signal, and searching for the bit error rate of said digital signal by which the error correction was carried out with said error rate calculation means.
[Claim 12] The digital signal receiving set according to claim 10 characterized by making an oscillating means generate vibration from which a frequency changes according to said error rate with said information means.
[Claim 13] The digital signal receiving set according to claim 10 characterized by displaying said error rate on an indicating equipment with said information means while making said oscillating means generate said vibration.
[Claim 14] The oscillation frequency of said vibration is a digital signal receiving set according to claim 12 or 13 characterized by being audio frequency.
[Claim 15] The oscillation frequency of said vibration is a digital signal receiving set according to claim 12 or 13 characterized by being the frequency in which the somesthesis below audio frequency is possible.
[Claim 16] It is the digital signal receiving set according to claim 10 characterized by for said transmitting means being a mobile

station and said unspecified location changing.
[Claim 17] While reproducing the synchronizing signal which carries out frequency conversion of said input signal, and is contained in the signal by which frequency conversion was carried out based on a comparison result as compared with a criteria synchronizing signal, carrying out a rectangular frequency multiplex recovery with said recovery means and acquiring said recovery digital signal Ask for the level of said signal by which frequency conversion was carried out, and the information about the multi-pass in said input signal is searched for based on said comparison result. The digital signal receiving set according to claim 10 characterized by including further a display means to display the level of said signal by which frequency conversion was carried out, and the information about said multi-pass on an indicating equipment.
[Claim 18] The information about said multi-pass is a digital signal receiving set according to claim 17 characterized by including at least one of the number of said multi-passes, a time delay, and level.

[Translation done.]